SCIENCE

TWELFTH YEAR.
VOL. XXIII. No. 576.

FEBRUARY 16, 1894.

SINGLE COPIES, TEN CENTS.
$3.50 PER YEAR, IN ADVANCE.

CONTENTS.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19, 1891. No response to date.

N. D. C. HODGES, 874 BROADWAY, N. Y.

SCIENCE

NEW YORK, FEBRUARY 16, 1894.

AN EXERCISE IN GEOLOGY.

BY G. D. SWEZEY, DOANE COLLEGE, CRETE, NEB.

A MOST profitable training to be had from the study of geology is found in the interpretation of geological maps and sections with a view to reconstructing the geography of the continent in various periods of geological time. Our text-books usually give the student such reconstructions ready made, but it is safe to say that they do not mean very much to the average student; he does not probably get farther into the matter than to wonder how anybody knows that there was an extended land mass in the Sierra Nevada region, for instance, during Palæozoic time when the geological map shows the region mostly covered with Jura-trias rocks.

As data for this exercise I compile, from as recent data as I have at hand, a geological map of the country and a considerable number of geological sections. For a blank map I use the map "Form C" of the United States Weather Bureau, 19×24 inches in size.

The geological map should be a simple one, omitting many small areas; it is not worth while, for example, to show the narrow lines of Cambrian and Carboniferous rocks bordering the Rocky Mountains; their presence will be disclosed by the geological sections; besides they would be rather misleading than otherwise, since they seem to imply that the Silurian and Devonian are there missing from the series. Nor should the intricacies of Appalachian geology be represented. I generally content myself with showing a very narrow line each of Cambrian, Silurian and Devonian bordering the Archæan area of this region on its western side.

I use one color for each period, as now recognized by the United States geologists, omitting, however, the Pleistocene or at least the drift deposits. For pigments I use the analin dyes, approximating as nearly as convenient to the colors adopted by the United States Geological Survey, as follows:

Neocene—Yellow analin tinted slightly with rosin.
Eocene—Yellow analin.
Cretaceous—Methyl green shaded with yellow.
Jura-trias—Methyl green.
Carboniferous—Blue analin.
Devonian—Gentian violet darkened with common ink.
Silurian—Gentian violet.
Cambrian—Rosin.
Algonkian—Yellow tinted with rosin.
Archæan—Bismark brown.

On the same sheet with the map is presented a generalized section across the continent, on the 40th parallel, showing the superposition of the rocks of the several periods, their relative thickness in different basins, their folding in mountain regions, their conformity or unconformity and some of the more extensive faults which the section crosses. This section along the 40th parallel happens to be an unusually instructive one, crossing, as it does, surface exposures of every formation, except perhaps the Algonkian, and revealing the geological history of our principal mountain systems; but in addition a number of local sections are needed to make clear the history of certain regions, especially where late formations entirely conceal earlier ones. I have represented sections across the Green Mountains and the basin to the east of them, across the Connecticut Valley, through one or more of the Great Lakes to show that they are erosion valleys, through the Black Hills, the Uinta range, the Texas Archæan and Algonkian, the Grand Cañon region, etc., etc. These sections should be on the same sheet with the map and numbered to correspond with lines on the map indicating their location.

Some of these sections must, it is true, be more or less hypothetical, but they should not be mere guesses; let the guessing be done, if it must, when we come to reconstruct the geography of the continent. Portions of the northwestern and southwestern United States are as yet so incompletely known that I do not attempt to include them in the map even.

Finally some lines of off-shore soundings should be drawn around the map to indicate where the real borders of the continental plateau lie.

In the first place each student should make for himself an exact copy of the map and sections. This will not be a very laborious task, as a blank map can be placed over the other against a window and the division lines copied through. By the process of drawing and coloring the map the student will get a better acquaintance with it than he could in any other way.

The classes are now prepared to trace the growth of the continent from period to period. Let them make at least one map showing the land and water for each period. Shade the land one color and leave the oceans and submerged portions of the continent blank; where the coast lines can be located with reasonable confidence, indicate them by the water-lines ordinarily used on maps; where they are quite hypothetical use dotted lines or some similar device; but let every student *make his map*, even though in places it must be largely conjectural. The smaller weather bureau map 9×12 inches will perhaps be better suited to this purpose.

I have been very much interested to see how, by this process, a geological map from being, to many a student, a meaningless patchwork of colors becomes significant and intelligible, almost a geological history in itself, in which the student can see in imagination not only the gradual extension of the continent southward from Canada during the earlier periods, but also the sinking archipelago in the west with only its higher summits finally peering above the engulfing seas.

I have suggested one map for each period; but there are some portions of the geological story so interesting on account of their widely changing conditions that several intermediate maps are most instructive: this is especially true of pre-Cambrian and early Cambrian times and also of the passage from Carboniferous through

Permian to Juratriassic times. For the former we are as yet poorly off for data, especially in Algonkian times; for lower Cambrian I send the student to Walcott's map in Bulletin No. 61 of the United States Survey, showing the occurrence of lower, middle and upper Cambrian deposits at various points; or better reproduce the map and show on it at the same time the Archæan exposures, so that it may be evident in what basin or valley each Cambrian section lies; then the mapping of the continent, first in earlier Cambrian and then in later Cambrian times, presents a very instructive picture to the mind's eye of the waters returning from their long retreat, after Algonkian times, into the ocean basins and gradually encroaching upon the continent, first filling the valleys along the borders, and finally invading the heart of the continent itself. The retirement of the waters in later Carboniferous and Permian times is an equally interesting spectacle.

Nor is the mere mapping of the land and water all that can be done. The question will arise as to what sort of a land it was: was it level or mountainous? How high did the Rocky Mountain islands and other lands rise above the sea? Such questions can be answered approximately at least by a study of the sections if they are carefully drawn. The student will discover, for instance, that the Archæan rocks of Nevada towered up high enough not to be submerged by the 30,000 feet or more of Palæozoic sediments that were deposited in the valleys to the eastward; in other words that mountains higher than any now existing lie buried under the modern Sierras. The student may represent these on his Palæozoic maps and indicate their gradually decreasing height from period to period.

Something, also, can be done at locating the old drainage systems of these early continents. In many cases it will evidently be safe to infer that the modern rivers are in the same old channels, especially in driftless regions; in other cases the pre-glacial history of rivers has been made out; a map of the pre-glacial drainage of the great lake region, like that in the *American Geologist* for Feb., 1891, for example, may be reproduced and hung on the wall, where it may be used in locating the probable course of the rivers of that region, in the various periods with which the class has to deal.

I wish that some one who is competent to do it would give us a handbook of elementary geology, which should consist largely in the presentation, by means of maps, sections, rock columns, tables and text, of such facts as the student could use in developing by laboratory methods his own "geological story briefly told."

THE BASIS OF SPELLING REFORM.

BY A. MELVILLE BALL, WASHINGTON, D. C.

MANY efforts have been made, and renewed from time to time, to correct the anomalies of English spelling; but, for the most part, these efforts have been resultless, except to intensify the prevailing sense of needed amendment. Strangely enough, the first requisite for any improvement in spelling has generally been lost sight of—namely the improvement of the ALPHABET. We have to write *g*, we have to write *h*, we have to write *n*, we have to write *s*, we have to write *t*, in thousands of cases where there is no *g*, *h*, *n*, *s*, or *t* to be pronounced. On account of a defective alphabet we are compelled to use unsounded letters to denote unrepresented sounds. For example, the consonant in the syllable *ing* has neither *n* nor *g* in its sound; the consonant in the syllable *ish* has neither *s* nor *h* in its sound; the consonants in the words *oath* and *they* have neither *t* nor *h* in their sounds; and these two sounds,—while as different from each other as *s* and *z*, *f* and *v*, *p* and *b*,—are both denoted by the same letters, *th*. With such glaring defects in the alphabet, any attempt to improve orthography by merely dropping redundant letters is but trifling with the subject. A workman must have appropriate tools, yet we expect our literary workman to dispense with a large proportion of his most necessary implements, and to spell forty sounds with little more than half that number of letters. We must commence our spelling reform by providing the means of writing our unrepresented sounds. Of these there are SIX, among consonants, as heard in the words

sing, *wish*, *pleasure*, *oath*, *they*, *why*.

When we shall have furnished the alphabet with representative letters for these elementary sounds it will be time enough to attend to the minor discrepancies in the writing of vowels. All the amendment that can be hoped for in the latter respect—without multiplication of new letters—will be brought about by the application of one rule, namely: OMIT ALL PHONETICALLY DISPENSABLE, OR SILENT, LETTERS. This rule will, without specific detail, take *a* from *head; e* from *have* and *give; i* from *friend; o* from *feoff* and *people; u* from *build*, etc. The rule has thus the advantage of simplicity and comprehensiveness, so that it may well take the place of the twenty-four rules of the philological societies, which only amount to the same precept "writ large."

Of the two classes of faults in spelling—deficiency and redundancy of letters—the former is by far the more serious and should be first rectified. Redundancies can be dropped at any time.

The one only drawback that can be urged against extension of the alphabet is that printers will require six additional types. But this objection is neutralized by the consideration that the trifling expense of additional types will be largely offset by the working economy of making six letters do the present duty of twelve.

The new consonant letters may be so designed that they will make but little alteration in the aspect of words, and so will be intelligible at a glance to every reader. The suggested forms introduced in WORLD-ENGLISH exemplify this fact, but in that system every word is made phonetic for "World" use. The present proposal limits inaugural improvement to the provision of letters for unrepresented sounds. Other improvements may safely be left to work themselves out by degrees, but there can be no radical improvement in spelling while we lack letters to represent one-fourth of the consonants in our language.

The attention of Congress has recently been again called to this subject; therefore the movement is opportune for its discussion. Let America take the initiatory step, and Great Britain and the English-speaking world will follow. The "initiatory step" will consist simply in an enactment that the Public Printer shall henceforth use prescribed forms of single letters to represent the six simple sounds enumerated above; and that he shall discontinue the use of the double letters now employed for the same purpose.

This is the true basis of SPELLING REFORM.

—Sydney H. Vines, Fellow of Magdalen and Sherardian Professor of Botany in the University of Oxford, is about to issue a "Student's Text-book of Botany," based upon Professor Prantl's "Lehrbuch der Botanik," but with the scope of the work so extended that, while retaining all that has made it of value to beginners, it will be more useful to those engaged in advanced study. The number of pages has been doubled by additions to all four parts of the book, but more especially to Part III., dealing with the classification of plants. The whole book, moreover, has been so revised as to render the present essentially a new and distinct work.

SCIENCE:

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

SUBSCRIPTIONS TO ANY PART OF THE WORLD, $3.50 A YEAR.

To any contributor, on request in advance, one hundred copies of the issue containing his article will be sent without charge. More copies will be supplied at about cost, also if ordered in advance. Reprints are not supplied, as for obvious reasons we desire to circulate as many copies of SCIENCE as possible. Authors are, however, at perfect liberty to have their articles reprinted elsewhere. For illustrations, drawings in black and white suitable for photo-engraving should be supplied by the contributor. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers may go directly to them. The "Exchange" column is likewise open.

PRESSURE OF THE VAPOR OF WATER.

BY H. A. HAZEN.

ONE of the more important facts needed in meteorology is the pressure of the vapor of water, commonly called "vapor pressure" for short. Until very recently Regnault had obtained the best values for this element. His method was to introduce a capsule of distilled water, from which all air had been expelled, into the vacuum of a barometer and there liberate the water. It is well known that this vapor will diffuse itself and absolutely saturate the space above the mercury. Its pressure will be exactly dependent upon the temperature and can be ascertained approximately by comparing the barometer reading with a perfect barometer. It is easy to see that many elements of inaccuracy are introduced in such an apparatus. Most of these have been eliminated by a most beautiful apparatus, designed and constructed by Prof. C. F. Marvin, of the Weather Bureau. I have made thousands of readings with it, and it is one of the most satisfactory instruments to manipulate I have ever seen. In this, the two barometers are dispensed with, but there are two vertical tubes connected at the bottom and partly filled with mercury. A bulb is attached to one of the tubes, and afterward the air is exhausted and vapor liberated by breaking a capsule of water previously inserted in the bulb. The heights of the mercury columns are read by means of a vernier. I found no difficulty in repeating again and again, and day after day, readings within .03 to .04 of a millimetre (.0012 to .0016 in.). A full description of a perfected apparatus will be found in the Annual Report of the Chief Signal Officer for 1891, pp. 351–383.

In January, 1890, I carried the apparatus with great pains to Northfield, Minn., and there made a series of readings, the results of which were published in the Annual Report of the Chief Signal Officer, 1890, pp. 658–662. Perhaps the most interesting result obtained was a marked difference in vapor pressure when the temperature of the water was different from that of the vapor. This is best shown in a series of comparisons of water at freezing and a portion of the vapor above it at different temperatures, as follows:

Water 32°.	Vapor Temperature Fahr.	32	42	52	62	72	82	92	102	112
	Vapor pressure	4.60	4.57	4.55	4.53	4.50	4.48	4.44	4.39	4.33

Most of the vapor in these experiments was at the temperature of the liquid.

It should be noted, in passing, that Professor Marvin did not obtain any effect of this kind, and in his results it is ignored.

There has just come to hand a very interesting paper, by Prof. Geo. W. A. Kahlbaum, of Basel, Switzerland, in "Archives des Sciences Physiques et Naturelles," Geneva, vol. 31, p. 49. In this paper the author shows very clearly that there is a marked effect depending upon the difference in temperature between the liquid and the vapor above it. The only portion of this investigation needed for our purpose is that relating to the vapor of water. To present the facts in the best possible shape for comparison I have placed in the following table values of vapor pressure at different temperatures by various experimenters. In the first column is the temperature of the vapor in degrees Fahr., and in the succeeding columns the pressure in millimetres of mercury, as observed by Regnault, computed by Broch from Regnault's observations, observed by Kahlbaum, by Professor Marvin, by myself, and as determined by the Royal Society of England, probably from the results of various observers, but this is a mere inference.

VAPOR PRESSURE IN MILLIMETRES AT VARIOUS TEMPERATURES.

(1) Fahr.	(2) Reg.	(3) Broch.	(4) Kahl.	(5) Marvin.	(6) Hazen.	(7) Roy. Soc.
0	1.02	1.14		.97	1.11	1.30
5	1.32	1.44		1.25	1.38	
10	1.72	1.81		1.60	1.72	1.98
15	2.18	2.25		2.06	2.18	
20	2.78	2.79		2.61	2.75	2.95
25	3.45	3.43		3.31	3.44	
30	4.25	4.22		4.17	4.25	4.37
35	5.17	5.15		[5.24]	5.17	
40	6.29	6.26			6.28	6.38
45	7.60	7.58			7.62	
50	9.16	9.14	9.36		9.15*	9.17
55	11.00	10.97	10.97		10.91	
60	13.15	13.22	13.13		13.05	13.11
65	15.68	15.65	15.67		15.59	
70	18.62	18.59	18.47		18.53	18.36
75	22.04	22.01	21.76		21.96	
80	25.99	25.96	25.67		25.88	25.53
85	30.56	30.52	30.51		30.30	
90	35.81	35.76	36.12		35.41	35.05

A comparison of (2) and (3) shows a tendency to error at very low temperatures in the mathematically computed results. I do not see how we can go back of the original record in such case. The values in (4) agree fairly well with those in (2), except at 50°, 70, 75 and 80. It is possible there is a misprint, otherwise there would seem to be some error in the values. It would be very gratifying if we had the results at the lower temperatures. Column (5) gives results which are lower than those in (2), and as the observations were all at temperatures of 70° for some of the vapor, it would seem, according to the law determined by two independent observers, that these values are all too small. Perhaps Regnault's work was done at temperatures of water, or ice, and vapor approximately the same, and, if so, his results may be very nearly correct, so far as this point is concerned. In column (6) all the values are reduced to a common temperature of water and vapor. These agree remarkably with column (2) till we reach 85°, when there is a falling off. It was found rather difficult to manipulate the apparatus at this high temperature, and it is also probable that whatever errors existed in the apparatus were largely increased at these higher temperatures, so that I do not insist upon the absolute accuracy of the results in (6) above 85°. It is a little singular that there should be this rather rapid fall in my values as compared with Regnault's, and I am confident they are not due wholly to errors in (6). There is another point of great interest in this connection. Column (4) is supposed to have this effect entirely eliminated, but that has a very sharp fall as compared with (2) at 70° $-.15^{mm}$, 75° $-.28^{mm}$, 80° $-.32^{mm}$, then a rise at 90° $+.31^{mm}$. It seems very difficult to account for these jumps in (4), and it may be that there is some error

at the highest temperature given. Column (7) is interesting as showing the extreme difficulty there is in securing reliable results in work of this kind. At the lowest temperature this gives .29^{mm} higher than (2); at 50° they agree, and at 90° column (7) is .76^{mm} lower than (2), and .36^{mm} lower than (6). It seems to me the work has now been narrowed within pretty small limits, and but little more is needed to give us an absolute standard of values of this important element, which enters into so many discussions in meteorology. I hope shortly to obtain values from Professor Kahlbaum at very much lower temperatures.

CURIOUS IROQUOIS POTTERY.

BY W. M. BEAUCHAMP, BALDWINSVILLE, N. Y.

THE common earthenware of the North is well known, and its styles of ornament are simple. Incised lines, rows of dots, notches either pinched or cut, impressions of corn or grass, small circles made by a hollow bone, are among these, but there are others which are almost unique. Hough speaks of rude attempts at human faces in pottery along the St. Lawrence River, and these appear in a more distinct manner on some Mohawk and Onondaga sites. On these they occur from about A.D. 1600 to 1640, apparently reaching their proper territory at the time of the migration of these two nations, which may have been a little before the earlier date here given.

The earliest hint of such attempts which I have seen in New York is in the arrangement of three dots to represent the eyes and mouth. Such examples occur in Jefferson County, N. Y., and in one of these the elliptical and horizontal indentations are placed inside four lines, arranged as a diamond, at the lower angle of the vessel. The point of the diamond forms the chin. In a similar one the boundary lines form a pentagon, with the apex above. Still another has a horizontal line for the chin, as in the last, and mostly the same general form. About this are lines and notches, and the three circular impressions were formed by a hollow bone. I have a pottery rim much like these, said to be from a small burial mound near Columbus, Ohio. In this, however, the small elliptic indentations have their longest diameter vertical. There are no distinct bounding lines, though two lines run parallel with the notched rim, and the general decoration is of vertical and diagonal lines.

In the more advanced types the body and limbs, when present, are almost always made of raised bars of clay, which are crossed by grooves. Rarely these bars appear without human faces. In the Canadian Institute Report, 1891, fig. 2, is the representation of a fine vessel from Lanark County, Canada, which has several such bars symmetrically arranged. I picked up a rim on the Seneca River, N. Y., which had two such raised bars, placed vertically and rising so far above the rim as to be continued within. They are each two inches long.

On one of the two early Mohawk sites I know of no earthenware of this description, though the general style is very bold. On the other I found a fragment of the largest figure that I have yet seen. It was broken through part of the angle, and though the body was gone its impress remained. One arm is nearly perfect and is 3.5 inches long. The vessel was ornamented with lines and notches, and this was continued below the projection. Usually this class of pottery has no ornament on the lower part. I figured a very elaborate specimen from the same early site. The face reached the top of the angle, and the feet to the lower edge of the projecting top. The limbs were less conventional in arrangement than usual, and there were many parallel and intersecting lines. The figure was but slightly raised, and may not have been made like the others. No European articles have been found on this site except two long and cylindrical brass beads.

A site in a like elevated position near the same stream is a little more recent, containing iron articles, copper saws of Mohawk make, unfinished bone combs, etc., and it is several miles nearer the river. It yields fragments of many of these vessels. In one the angle is low, and the small face is close to the rim. There is a curious arrangement of dots and lines. Another has a large face, with general ornaments of lines and notches. The most curious one I have seen came from this spot. The figure is rather large, and while one extended arm has the left hand raised, the other has the right hand turned down. Fingers and toes are also represented, and the general surface has some incised lines. Another with a small face and body has circles for eyes, with a raised surface in the centre of each.

On a still later site a few miles east of this I found an angle of a vessel with a projecting head above the level of the rim. The face is round and flattened, with very wide eyes and mouth, suggesting an ape. The body forms a single bar with the usual cross indentations, and lines slope away from it on either side. I have seen nothing like it. In the same place I found another fragment, one arm and part of the body remaining, and on these were deeper notches than usual, of an elliptic form. The face was broken off from another. It was placed below a dotted angular rim, and the body was slight. In this one lines of dots represented the arms instead of bars. Still another preserved the face and body, the latter in two vertical lines, whereas it is usually in one. At a site not far from this the face at the angle of a broken vessel was broken off, and the legs reached only to the edge of the upper projection. The body of this was also double, and the arms were nearly perpendicular, but not symmetrically arranged. They had fingers. All these were from the north side of the river.

I have a figure of but one on the south side, and think the early clan there made few or none. This one had a curious face and body. Three circular dots represented the eyes, and the shoulders were distinctly rounded. Of a few Mohawk specimens I made no figures.

The Onondaga forms are remarkable in the frequent occurrence of the detached faces, especially on their earliest site. The range in time is about the same as the Mohawk, and all have been found within a distance of six miles except one specimen. The detached faces are of many sizes and features, but a broad, good natured face was quite a favorite. Usually the face is placed squarely on the vessel, but sometimes it has an oblique position. One has a large nose and projecting forehead, and this, like most of the others, is from the site occupied about 300 years ago. Excepting one already noted this has the only example of the perpendicular raised bars which I have seen here unconnected with heads. Among the Mohawk specimens the legs usually end with the projecting upper part. Here they often extend below. One of this kind has the arms represented by lines of dots. A face below a notched rim shows traces of arms but no body or legs. The parallel legs of another are over two inches long. One round face has a broad body, which has no lines across it, but they may have been worn away. Another body is very broad and has lines; the extremely short incurved legs end in long toes in this example.

Several miles southwest of this is the next site in point of time. One fragment has a very high angle, with the head, body and arms on the upper part, which is decorated with lines and dots. Two slender legs appear on the sharply receding lower part. Another has a twisted face

and mouth under a notched rim. One detached face has much the character of some of the heads at Hoclulago, but the Onondagas seem to have made some terra cotta articles merely as ornaments.

Two other later sites, not far off, supply some more articles of this kind, but it is needless to describe all of these. Quite a number have been passed over now. On the earliest of these Onondago sites are occasionally found some large and curious clay pipes, with from four to five grotesque faces encircling the top of the bowl, while others intertwine all down the curving sides even to the mouthpiece. I have seen them nowhere else.

Of this pottery one fragment with a face at the angle was recently found on a fishing site near the head of Onondaga Lake. It is of interest as showing that the Onondagas even then visited the lake, though their homes were far away. It is interesting, too, to find that the Mohawks and Onondagas, the real founders of the Iroquois League, both had this unique pottery for a short time three centuries ago, and that it has not yet been found in the homes of the other Iroquois.

HOW ALUMINIUM IS OBTAINED FROM ITS ORES.

Aluminium is now so rapidly growing in demand with the cheapening of the metal that it attracts more or less popular attention. In the form of clay the metal is all around us, but this ore is too poor in the metal and too difficult of working to make it a profitable source of supply. Corundum is the oxide and theoretically nearest the metal from a metallurgical point of view. Indeed, the metal has been extracted from this mineral on a small commercial scale, but the supply is too limited.

The metallurgy of the aluminium is theoretically the same as iron, that is, the compound used for extracting the metal is in each case an oxide. The oxygen in both cases is removed by carbon. The facility of carrying into practice the extraction of the metal is entirely different. In an ordinary blast furnace the carbon of the coal or coke easily extracts the oxygen from the iron ore, so that a pound or two of coal produces a pound of metallic iron. The oxide of aluminium defies such easy processes, and requires a temperature vastly greater than the fiery iron furnace. This is obtained by electric currents, and a process of electro-metallurgy is adopted. A trough is lined with gas carbon. In this, cryolite to the extent of 500 pounds is placed. Into this press, enormous electrodes are inserted, and the heat melts the cryolite, which is not decomposed by the electricity. With this fused mineral, about a third of its weight of oxide of aluminium is mixed, and it is soon dissolved. In this condition the aluminium compound is decomposed, the oxygen being removed at the expense of the carbon electrodes, and the molten particles sink in the cryolite. As the cryolite (fluoride of aluminium and sodium) is not consumed, the operation is continuous. However, the affinity between the metal and oxygen is so great that not merely the carbon of the electrodes is consumed, but about 75 pounds of coal are needed to develop horse-power to produce electricity enough to decompose the oxide.

From the method pursued, we see that the ore most available is that nearest approaching an oxide and rich in the metal. Of the natural compounds occurring in large quantities, beauxite is the most important. This is essentially a hydrated oxide of aluminium, but with usually an admixture of oxide of iron and frausilica. A high grade ore contains 60 per cent of alumina, only one or two per cent of each of the other constituents, and the balance is water. In this country the beauxite occurs in Georgia, Alabama and Arkansas. It is from the recent volume on the Paleozoic Belt of Georgia, by Dr. J. W. Spencer, that we derive the materials for this notice. This report is the most exhaustive treatise upon beauxite which has appeared in this country. The mineral occurs as masses of small concretions in great products in the Knox dolornite (the lowest formation of the Lower Silurian system). Where it is formed, the calcerous matter has been leached out of the impure limestone, leaving a great mass of a peculiar siliceous clay or loam, which is sometimes 200 feet thick. This represents that as much as 2000 feet of limestone have been removed from the region, which has been exposed to atmospheric degredation for long geological ages. As the alumina has resisted solution, a process of concentration has gone on so that the accumulations make themselves conspicuous. The ore always occurs in proximity to brown iron and manganese ores. The author explains their occurrences as having been brought down in solution by streams and deposited in lagoons, in which the limestones were also forming. The author gives us here an interesting chapter on chemical geology, without saying so in his treatment of the origin of the beauxite. Under the conditions of occurrence ferric oxide often replaces a portion of the alumina, sometimes to the extent of twelve or fifteen per cent. This, however, is no injury, for in preparing alumina for furnace uses a valuable bye-product is obtained. Silica may sometimes reach 20 or 30 per cent. In this case, the mineral must be considered more or less a mixture of beauxite and clay. Amongst the beauxite, iron and manganese deposits, great pockets or "horses" of clay, or often kaolin, are frequently seen. When the silica is present in such quantities the mineral becomes too poor to be of use. For making alumina the beauxite is fused with soda, from which mass the pure alumina is extracted. With the visible supply of beauxite and greater economy in the power consumed, we may hope before very long to see the metal at twenty-five or thirty cents a pound, when its uses in the arts will be enormously increased.

—When we examine the total number of books that have for their subject an Oriental country we are surprised to find how large a proportion of them have been written by travelers who were there for a comparatively short period, who did not understand the language of the people they describe, and whose knowledge must, consequently, have been acquired mainly at second-hand. It is a pleasure, therefore, to find in Miss Adele M. Fielde's forthcoming volume—"A Corner of Cathay"—a graphic record of original research concerning the life of the Chinese, by one who lived among them for twenty years, and whose familiarity with their language enabled her to enter into their modes of thought, and to ascertain from themselves the reasons for their peculiar and amazing customs. As an inmate of native households she possessed peculiar facilities for a study of their life, domestic, social, and intellectual, from the question of the legal status of the women to the curious games played by the children. In her illustrations she was aided by a native artist of wide local fame, and his pictures, as winsomely guiltless of perspective as were those of the early Italian artists and as charming in tint as Pekinese enamels, are skilfully reproduced in colors and present a new feature in American illustration. The name of the book is taken from the populous and picturesque region about Swatow, in the southeastern corner of China. It will be published by Macmillan & Co.

CURRENT NOTES ON CHEMISTRY.—VI.

(*Edited by Charles Platt, PhD., F.C.S.*)

SILICON CARBIDE.

CARBIDE of silicon, or "carborundum,"[1] has already become a familiar term, and the material is now upon the market as a formidable competitor of the highest grade abrasives. It is interesting to note some of the chemical aspects of this substance as given by Dr. O. Mühlhæuser. To obtain the pure compound corresponding to the formula SiC the crystals are heated to dull redness in oxygen, boiled with potash solution, washed, digested with hydrochloric acid, again washed, and finally treated with hydrofluoric and sulphuric acids. It is insoluble in all acids, but is attacked by molten alkalis and by hot ferric oxide and, when very finely divided, can be slowly burned in oxygen. Its specific gravity is given as 3.22 at 15°C, but the fine powder will remain suspended in water for months. The following suggestions are made for analysis: The powder obtained by trituration in an agate mortar is submitted to elutriation and the carbon determination made with that portion which remains in suspension after five minutes. The carbon is best estimated by combustion with twenty parts of lead chromate, the addition of potassium dichromate causing the oxidation to proceed with explosive violence. The silicon is determined by fusion with potassium sodium carbonate for about six hours, during which time the heat should be increased very gradually. A very pure specimen gave by analysis: Carbon, 30.2 per cent; silicon, 69.1 per cent; oxides of iron and alumina, 0.46 per cent; lime, 0.15 per cent; magnesia, 0.09 per cent.

H. Moissan has produced the carbide by dissolving carbon in fused silicon, but states that it can be much more easily prepared by heating in an electric furnace a mixture of twelve parts of carbon with twenty-eight parts of silicon. It is also produced by heating carbon and *silica* in the electric furnace or by allowing the vapors of carbon to come into contact with vapor of silicon, when it is obtained in almost colorless, very hard and brittle, prismatic needles. Moissan gives the specific gravity at 3.12, which is also that determined by Professor J. W. Richards. According to Moissan, the carbide is not affected by oxygen at 1000°C, nor when heated in air by a Schlœsing's blowpipe. Sulphur vapor at 1000° is also without action, while chlorine attacks the compound very slowly at 600° and rapidly at 1200°. Fused potassium nitrate, or chlorate, boiling sulphuric acid, nitric acid, and hydrochloric, aqua regia, and mixtures of nitric and hydrofluoric acid are all without action. Fused lead chromate oxidizes the carbide, but repeated treatment is necessary to obtain complete combustion. Fused potassium hydroxide gradually converts it into potassium carbonate and silicate. Mühlhæuser has also described a boron carbide obtained by heating a mixture of boric anhydride with carbon in the electric furnace. A graphite-like mass is obtained, which after further heating in a platinum crucible and boiling with acids yields, on analysis, BC, or B_2C_2. It is described as a black powder having similar properties to graphite, burning with difficulty in oxygen, insoluble in nearly all of the usual solvents and decomposed by fusion with alkali. It is significant that the Carborundum Company are about to increase their capital stock, and that among other recent orders one has come from London calling for $10,000 worth of material.

FORMATION OF PRECIOUS OPAL BY THE ACTION OF HYDROFLUOSILICIC ACID ON GLASS.

PROFESSOR G. Cesàro, of the University of Liége, describes in the Bulletine of L'Académie Royale de Belgique the formation of precious opal and other substances by the action of hydrofluosilicic acid on a glass-containing vessel. The glass was attacked very unequally, the upper portion, that above the level of the liquid, being acted upon most strongly, with the production of cellular cavities containing a white translucent substance. In these cavities and also attached to the bottom of the flask were likewise found beautiful, limpid crystals of hexagonal form with others, unattached, which were apparently tetragonal. The opalescent mass was built up of concentric layers, which were easily separated and which produced fine iridescent effects. This substance proved to have the composition, silica, 90 per cent; water, 10 per cent; corresponding precisely to the precious opal of Hungary and from the chemical point of view to the polysilicic acid, $3\ SiO_2 . H_2O$. The formation of this opal is easily understood from the reaction:

$$6\ SiO_2 . Na_2O . CaO + 2\ H_2SiF_6 = Na_2SiF_6 + CaSiF_6 + 2\ (3\ SiO_2 . H_2O)$$

The hexagonal crystals found by their chemical and physical properties were determined as fluosilicate of sodium, Na_2SiF_6. The crystals give in converged light a uniaxial interference figure; they are negative in character and show a weak double refraction. The index of refraction for the ordinary ray is 1.300 and for the extraordinary ray 1.296. The remaining crystals, spoken of as apparently tetragonal, were determined to be biaxial and orthorhombic ($\frac{a}{c} = \sqrt{3}$), consisting of a soluble potassium fluosilicate. Finally in the liquid was found a fluosilicate of calcium. It will be seen that both the fluosilicate of calcium and of sodium, as well as the opal itself, are explained in the reaction above given.

These experiments recall the historic ones of Daubrée in Paris, who, by superheated water alone, altered a glass-containing tube with the production of hydrated silicates resembling zeolites (Pectolite?) and of an alkaline silicate in solution, together with innumerable colorless, bipyramidal crystals of quartz, minute spherulites, microlites and even a green pyroxene (Diopside?).

INERTNESS OF QUICKLIME.

IT is now a well-known fact that in the absence of moisture many elements and compounds which ordinarily react upon each other readily and even with explosive rapidity are rendered inert. Thus mixtures of oxygen and hydrogen if perfectly dry can not be exploded by the electric spark. Many chemists are now working on these lines, and all contributions are of interest in extending the experimental data. Mr. V. H. Veley has already shown in the Journal of the Chemical Society of London that quicklime does not combine to an appreciable degree with carbonic or sulphurous acids at temperatures below 300°C., and now in a more recent paper he has investigated the reaction between the same substance and chlorine. The result of Mr. Veley's experiments is to confirm the observation of others, his conclusions being, first, that dry chlorine does not combine with dry lime at ordinary temperatures to form the so-called bleaching powder; second, that no appreciable chemical change is observable between these two substances below a temperature of 300°, when a partial replacement of oxygen by chlorine takes place, the conditions being analogous to that of baryta and chlorine not specially dried and at ordinary temperatures. It seems probable to the writer that Veley's method of "drying" is the real explanation of the slight reactions obtained below 300°, in other words that *no* action would take place below that temperature were the chlorine and lime *absolutely* dry.

BARIUM AND STRONTIUM IN SILICATE ROCKS.

AT a recent meeting of the Geological Society of Washington, and later at the Baltimore Meeting of the American Chemical Society, Mr. W. F. Hillebrand presented a

[1] W. R. Blake in *Science*, XXII., 554, p. 141.

valuable series of papers on the widespread occurrence of barium and strontium in the silicate rocks, with methods for the determination of these elements in small amounts. Mr. Hillebrand also deplored the laxity existing in rock analysis and brought forward a strong appeal for greater completeness in the future. The papers are of extreme interest and hardly permit of abstract but can be found in full in the February Journal of the Chemical Society.

THE EXAMINATION OF BEESWAX.

MR. LYMAN F. KEBLER has recently published the results of an investigation of commercial beeswax, his general conclusions being as follows: He finds the beeswax upon the market to be adulterated to the extent of 50 per cent, while in the English markets this adulteration may even reach 66 per cent. The melting point varies from 62°–74°C. It is raised by adding carnaüba wax, stearic acid, certain mineral waxes and paraffin, and is lowered by China wax, Japan wax, cacao butter, resin, tallow, spermaceti, vegetable wax, etc. On the other hand the melting point is apparently unaltered when suint wax and certain of the mineral waxes are used. The specific gravity of the pure wax varies from 0.960 to 0.973, and this appears to be greatly influenced only by resin, carnaüba wax and certain mineral waxes, which raise it, and by paraffin, which lowers it. The "acid number" ranges from 19–21 mg. of potash per gramme of beeswax. Stearic acid resin and suint wax increase, while carnaüba wax, mineral wax, cacao butter, paraffin and spermaceti decrease the acid number. The "ether number" varies from 73–76 mg. of potash per gramme of beeswax and is increased by China wax, Japan wax, cacao butter, tallow and vegetable wax. It is unaffected by by addition of carnaüba wax but is lowered by mineral wax, paraffin, resin, stearic acid, etc. It must be noted in this connection that wax bleached by certain chemical agents may have on either number as high as 84 and yet be pure. The percentage of iodine varies from 8–11, but here also certain bleaching agents, such as chlorine, destroy the value of this test. Paraffin, mineral wax and stearic acid lower the percentage, while cacao butter, resin, suint wax and tallow increase it. The volume of hydrogen (53–57.5cc) evolved from one gramme of beeswax and the percentage (12.5–14.5 per cent) of hydrocarbons evidently are the most reliable data securable, the former being vitiated by all adulterants excepting tallow, and the latter by all except suint wax. The author gives a resumé of the best methods employed with many references to the literature.

BUTTER NOSTRUMS.

VARIOUS nostrums for increasing the yield of butter have long been more or less secretly upon the market, and notwithstanding their frequent exposure, they no doubt meet with considerable sale. Professor H. W. Wiley has again called attention to these frauds in Farmers' Bulletin No. 12, United States Department of Agriculture. It is claimed that from one pound of butter, one quart of milk and a little of the magic butter compound, two pounds of butter can be made! Analysis shows this compound to consist of common salt, coloring matter and a little pepsin or rennet. Such a mixture churned with the butter and milk merely coagulates the latter and allows of its incorporation, together with considerable water, into the resulting "butter" mass. Such outrageous adulteration can be easily detected by melting a sample in a test tube and comparing with a similar sample of genuine butter, the latter showing the fat in a clear limpid mass with only a small amount of water and a little curd, while with the former almost half of the whole volume will be a mixture of water, curd, and foreign substance. These compounds are retailed at from $2.00 to $2.50 a box of about two ounces.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The Editor will be glad to publish any queries consonant with the character of the journal.

Comment on "A New Thermo-Electric Phenomenon."

AN article has recently appeared in *Science*,[1] entitled "A New Thermo-electric Phenomenon." It is from the pen of W. Huey Steele, and has been copied and abstracted in several journals. Previous to seeing Mr. Steele's article, but not previous to its writing, I had made a few rough experiments along the same lines and had looked up the subject, historically, to see what had been already done.

From what I have been able to find out, in the course of my reading, it seems to me that Mr. Steele's phenomenon is not "new" at all, but is, perhaps, a slightly different phase of an old phenomenon first discovered by Becquerel in 1829.[2] Becquerel found that in a platinum wire, strained by a spiral and heated at one side of the strained portion, there is an electric current set up, and he thought that this was due to a difference in the propagation or movement of the heat to right and left of the heated portion. However, Magnus and Matteucci have shown that in a homogeneous metal the differences of temperature and of section are not sufficient to produce a current, and Becquerel's phenomenon should be attributed to a difference in the molecular state.

In addition, Sir William Thomson[3] has shown that thermo-electric currents were set up between the strained and unstrained portions of a single metal constituting a circuit; the effects in copper and iron being opposite, and the residual effect in each case being the reverse of the effect when the metals are temporarily strained. He also found the relations between hammered and unhammered iron and between brittle and soft iron.

To my mind these experiments are almost identical with those of Mr. Steele; practically no wire can be obtained that has not been through its own history of various strains. (The process of wire-drawing leaves the metal in a permanent state of elongation, and the residual thermo-electric effect, in that case, is the reverse of the effect which is induced by the force applied during the wire drawing.) As for the metals which he completely melted, I think there can be no doubt (from the very fact that "the effects are not always steady; in fact, they very seldom keep steady" and the *direction* of the currents keep shifting) that the melted metal was continually undergoing strains brought about by currents and strata of the metal shearing past one another, or, in other words, by a difference in the molecular state at different times. In addition there is probably, in the case of the melted metals, a large effect due to the thermo-electric action between the melted and solid metal that leads to the galvanometer, those at the opposite ends of the "clay tubes" being in different and continually changing molecular relations.

Becquerel must have obtained a considerable E. M. F. when he heated his platinum wire *to a white heat* and strongly affected a galvanometer of 1829. From these considerations I do not think that Mr. Steele's is a "new" phenomenon, and I think that everybody that reads his article and compares it with those of Becquerel and Thomson (which are far too extensive to even outline in this note) will agree with me.

In the opening lines of his paper Mr. Steele says that it has been "generally known that electric currents may be produced by heating a single metal, if there be any

[1] Nov. 10, 1893.
[2] Becquerel's "Traité d'Elec. et Mag.," Vol. I., p. 155.
[3] Phil. Trans., 1856, p. 711 et seq.

variation *in temper*, or if the distribution of heat be very irregular and the changes of temperature abrupt." However, this, to me, is only partial and does not touch the root of the matter—a molecular dissymmetry.

Perhaps this comment is totally uncalled for, but as there are already so many apparently different phenomena and "effects," in physics, it is well, when we can, to ascribe all modifications of any effect, that are manifestly due to the same principle, to that effect, instead of setting it down as a *new* phenomenon. W. R. TURNBULL.

Ithaca, N. Y.

Birds Singing on Their Nests.

IT is one of the encouraging hopes in natural science that taking anything for granted is giving way to facts. It is but a few years ago when one of our popular ornithologists said that birds were silent on their nests, else it would betray their nests. I had never seen anything in print to the contrary, up to 1886, when I discovered the nest of a white-eyed vireo from hearing the song proceed from one direction. I cautiously followed it, to find the bird on the nest. And here I may say I saw the male and female change places on the nest about noon every fifteen or twenty minutes; the male singing all the time on the nest as heartily as when off it. In February, 1892, I communicated these facts to the *Ornithologist and Oölogist*. It came out in "Bird Notes" in March, 1892, after which several correspondents from widely differing localities testified to hearing other species of vireos and the black-headed grosbeak of California singing on the nest.

In the April number of the *Ornithologist and Oölogist*, 1892, Clyde L. Keller writes: "It seems to be a trait peculiar to that family (vireos). I have observed both cassius and the western warbling vireo singing on their nests." In the next month, May, Mr. S. R. Ingersoll writes: "Let me add both the red-eyed and warbling vireos singing on their nests, especially the latter variety," (speaking of the eastern warbling vireo). This takes in so many of the vireos that it is probable all the family have this peculiarity. One may at first wonder that it was so long undiscovered. I think the solution lies in the fact that all these birds I hear of not being silent on the nests are all birds that have their nests well concealed. I had looked many years in vain for a goldfinch's nest before I could find one, till my ears helped me. Passing by a tree several times a day, I heard the voice of a female in the tree answering the call of a passing male. After searching some time I discovered her sitting on her nest, as well concealed as a goldfinch knows how to do it, so that the risk of betraying the nest is not great, with such birds as we now know to sing on their nests.

HENRY HALES.

Ridgewood, N. J.

Effects of Weather on Scientific Work.

VERY few persons recognize the sources of error that come directly from atmospheric conditions on experimenters and observers and others. In my own case I have been amazed at the faulty deductions and misconceptions which were made in damp, foggy weather, or on days in which the air was charged with electricity and thunder storms were impending. What seemed clear to me at these times appeared later to be filled with error. An actuary in a large insurance company is obliged to stop work at such times, finding that he makes so many mistakes which he is only conscious of later that his work is useless. In a large factory from ten to twenty per cent less work is brought out on damp days and days of threatening storm. The superintendent in receiving orders to be delivered at a certain time takes this factor into calculation. There is a theory among many persons in the fire insurance business that in states of depressing atmosphere greater carelessness exists and more fires follow. Engineers of railway locomotives have some curious theories of trouble, accidents and increased dangers in such periods, attributing it to the machinery. These are common illustrations and can be confirmed in the experience of all thoughtful observers. If some one would gather up reliable facts and tabulate them in this field, no doubt some laws of mental activity would be found. In an inquiry among active brain workers in my circle I find a settled conviction that many very powerful forces coming from what is popularly called the weather control the work and its success of each one. The psychology of the weather should be a most pregnant new land for study, and I would be pleased to hear from any one who may have some personal experience on this topic, for the purpose of making some future studies for the readers of *Science*.

T. D. CROTHERS, M.D.

Hartford, Conn.

A Freak of Inflorescence.

AMONG several hyncinths blooming in the window there is one which reverses the usual order of inflorescence. Its first spike of flowers was normal, that is, indeterminate, but the second began to bloom at the top, its lowest blossoms opening about the same time as the upper ones on the first spike. A spike on another plant began near the middle to open its flowers, and continued the process in both directions.

My observation of "late-blooming trees" has been that generally the second blossoming occurs only when the normal action of the tree has been in some way thwarted. A number of Duchesse pear trees blooming so early as frequently to get touched by frost are almost sure to bear clusters of blossoms the following August. A Siberian crab, in one of its off years, bore in July several clusters of flowers. These were larger than the ordinary flowers, and nearly as double as a Baltimore Belle rose. The summer flowers of the pear trees, on the contrary, are generally not so large, nor so many in a cluster as the spring flowers.

LUCY A. OSBAND.

Ypsilanti, Mich.

Maya Hieroglyphs.—A Correction.

IN my first article on the "Interpretation of Maya Hieroglyphs by their Phonetic Elements" (*Science*, Dec. 15, 1893), p. 325, 2d col., 3d line from bottom, for 162 read 102; p. 327, 2d col., 5th line, for 123 read 125; 43d line, for 136 read 128, 129; p. 328, 1st col., 32d line, for mout read mouth; 4th line from bottom, for 84 read 86; 20th line from bottom, for 166 read 167; 21st line from bottom, for 165 read 166; fig. 35 should have been given in the illustration, but was omitted from the drawing sent. It is composed of three squares, similar to those given in fig. 128, and has the phonetic value xa v/s, sha v/s, cha v/s.

H. T. CRESSON.

The Native Calendar of Central America and Mexico.

IN *Science*, Feb. 2, and also in the *American Anthropologist* for January, Dr. Cyrus Thomas publishes some observations on the above subject, bearing upon my recent work, "The Native Calendar of Central America and Mexico" (Philadelphia, 1893). As Dr. Thomas is evidently under some misapprehensions as to my statements, I beg to place them in a somewhat clearer light.

In the *Anthropologist* he undertakes to correct some of my quotations from the writings of Dr. Ed. Seler; but from his own words, it is plain that Dr. Thomas is very

imperfectly acquainted with the writings of that distinguished antiquary. For instance, the name of the fifth day in the Maya calendar is *chicchan*, which in one of his articles, published in 1888, Dr. Seler derives from *can*, serpent, and *chi*, to bite; but in a later paper, published in 1891, he retracts this etymology, and says, "Jetzt ist es mir zweifellos, dass es *chic-chaan*, d. h., 'tomado señal,' 'tomado aguero,' bedeuten soll." Dr. Thomas, unacquainted with the latter article, asserts that my quotations were not correct, and questions the translation. It is good for reviewers, as well as writers, to keep themselves acquainted with the current literature of their own special branches.

Dr. Thomas also objects to my interpretations of the Maya month names from religious ceremonies held at certain seasons, stating that it is "totally different from the method by which the names of the months of other calendars were obtained";—entirely overlooking the fact (for I cannot suppose he is ignorant of it) that the Nahuatl month-names are recognized by all to have been derived just in this way.

In his letter to *Science*, Dr. Thomas fails to grasp Mrs. Nuttall's theory. There is no fixed relation of the ceremonial year of 260 days to each civil solar year of 365 days; but in a cycle of exactly 37 solar years, 13,515 days, the two calendars coincide; and there is certainly some evidence that this cycle was noted and celebrated by both Mayas and Mexicans. We may well leave, however, further discussion of this intricate subject till the appearance of Mrs. Nuttall's work, now in course of publication by the Peabody Museum of Archæology.

The analogies which Dr. Thomas endeavors to point out in favor of a Polynesian origin of the calendar are not impressive. For instance, 8 months, 232 days, surely does not "correspond somewhat closely with the sacred period of the Mexican calendar," which was 260 days. Nor is it easy to see why it is such a "singular fact," that the Javanese, like the Mexicans, had a five days' week, since both employed the quinary method of enumeration. As to the Hawaiian system, Dr. Thomas is quite right in speaking of the accounts of it as "in evident confusion"; therefore the less we base analogies upon it, the more creditable will be our caution.

D. G. BRINTON.

Philadelphia.

Mining Exhibits at Chicago.

THE anonymous writer of the article entitled, "The Columbian and the Centennial Expositions," in *Science* of Feb. 2, we think unjustly criticizes the exhibits of the Mining Building. It is evident that the writer, in common with probably nine-tenths of the visitors, has passed judgment on the exhibit as a whole by examining merely those parts of it which were displayed on the ground floor. To a lover of educational features in the exhibit nothing could arouse greater regret than that so vast an amount of space on the ground floor was devoted to "great piles of rocks and ores utterly without system" and to the veritable storage of practically worthless, unlabeled material in expensive showcases, as for example in the wretched Mexican display. Your correspondent most justly condemns such waste of space, but when he attempts to score "the rest" of the exhibits, it is very easy to see that he overlooks the gallery exhibits, which in educational value far exceeded any at the Centennial. In Philadelphia exhibits of considerable interest, but of no scientific value, were scattered through several buildings; and the "Mining Annex," itself an afterthought, and added to the main building merely to supply the demand for space, contained little that was comparable even to the exhibits on the ground floor of the Chicago Mining Building. The elaborate, and on a whole excellent, metallurgical display in the west gallery, though defective, had no competitor at the Centennial; the most instructive Coke exhibit, the admirable abrassive exhibit, the large floor chart of the coal fields of the United States, and the collections of building stones all in the east gallery and the grand display of oils in the north gallery, the mere decoration of which we understand cost $65,000, are not even mentioned by your correspondent, and probably he never ascended the tiresome stairways which led up to the real mecca of the few who desired to study the educational exhibits in the Mining Building. Nor is mention made of the great systematic collections of minerals and rocks displayed respectively in the east and west galleries. It is worth noting that every specimen in two of these collections was labeled with its species, crystallographic form, chemical formula and locality, and so mounted as to clearly display the label, which in one collection was invariably a printed one. These systematic collections were unquestionably the best labeled, most complete and scientific, ever shown at any World's Fair. Two fine displays of gems in the rough and cut, in the west gallery, are also overlooked. It is easy to find fault, but far better, in our judgment, to discern merits, and as a mineralogist who visited the Centennial more than a score of times and spent six months at the Columbian Exposition, the opinion here expressed that the mining exhibit at Chicago far exceeded that at Philadelphia may coincide within the unwritten opinion of many a mineralogist.

GEO. L. ENGLISH.

New York.

BOOK REVIEWS.

Histories of American Schools for the Deaf, 1817–1893. Edited by EDWARD A. FAY. 3 vols., octavo. Washington, D. C., The Volta Bureau.

THE historical sketches contained in these goodly volumes were prepared for the Columbian anniversary, the enterprise having been first suggested in December, 1892. They give accounts of all the schools for the deaf that have been established in the United States, Canada and Mexico, most of the histories having been prepared by the heads of the various schools or by persons designated by them, several of the writers being deaf themselves. The different articles of which the work consists are printed and paged separately, the printing in many cases having been done by pupils or graduates of the schools, and the volumes are profusely illustrated with portraits and other pictures. Most of the schools are public, and supported in whole or in part by the state; but private and denominational institutions are also included, the whole number of schools dealt with being seventy-nine in the United States, seven in Canada and one in Mexico. Besides the histories of the various schools, these volumes contain an introduction by the editor, an account of several conferences of the instructors and also of the American Association to Promote the Teaching of Speech to the Deaf, together with many statistical and personal items pertaining to the general subject.

Of the schools whose origin and history are here recounted, the greatest interest naturally attaches to the earliest ones and to those which at a later time introduced the system of oral teaching. The editor in his introductory note alludes to the first establishment of the European schools for the deaf, which were the models of our own; and the opening chapters of the first volume describe the founding of the first two American schools, the American Asylum at Hartford, which was opened in 1817, and the New York Institution, which originated independently the following year. The remainder of the

work tells what progress has been made since, both in the establishment of schools and in improving the methods of teaching. The difficulty of teaching language to the deaf has made it necessary to confine the instruction for the most part to the elementary branches; but the higher education has been given to many pupils, and as the time for instruction has been lately increased by admitting the pupils at an earlier age, the opportunities for higher education are now much improved. Special care is taken in many of the schools to train the pupils in some mechanical art, so that they may become self-supporting; and these measures have been attended with gratifying results.

The system of oral teaching and lip-reading, though long practised in Germany, was not introduced into this country until 1867, when the first school to employ it, the Clark Institution at Northampton, Mass., was opened under the presidency of Mr. Gardiner G. Hubbard. A few years later Mr. Bell adapted his father's system of visible speech to the instruction of the deaf, and under his enthusiastic advocacy oral teaching has rapidly grown in favor, and is now employed in a large percentage of cases. At first, indeed, it was opposed even by some of the ablest teachers, who believed it would be detrimental to the pupils themselves; but experience has so shown that for many pupils it is really the best method. Besides oral teaching, many other improvements have been introduced from time to time, until now the American schools for the deaf are equal to any in the world.

Of the Canadian schools described in the third of these volumes, several are private Catholic institutions, and their history is written in French; but the Canadian governments have not neglected their duty in the matter, and the deaf children of the provinces are now as well cared for as our own. Mexico is far more backward, only one school having yet been established; and much remains to be done to bring that country up to the level of her northern neighbors. For further details of the work described in these volumes we must refer the reader to the books themselves, and we are sure that he will rise from the perusal with a fuller appreciation of the good which the schools for the deaf are doing, and with the best wishes for both teachers and pupils.

Die Ruinenstatte von Tiahuanaco. By A. STUBEL and M. UHLE. With one chart and forty-two plates. Breslau, C. T. Wiskott, 1892.

IN the present work the learned authors have given the results of Dr. Stübel's investigations at Tiahuanaco, together with an exhaustive presentation of what is known about the history and traditions connected with the ruins which have attracted so much attention since the earliest times. The amount of information collected by Dr. Stübel during a stay of a little more than a week is really astounding. His measurements give us for the first time an adequate idea of the curious stone carvings and architectural pieces which have been described by D'Orbigny, von Tschudi and Squier. We also find here for the first time accurate reproductions of the interesting reliefs which are found on the façade of the large monolithic gateway. Besides these figures illustrating the ruins which were investigated by Dr. Stübel, the book contains a large map and a panorama illustrating the situation and the scenery in which the ruins are found. It was an exceedingly difficult task to interpret the meaning of the curious stone carvings which showed plainly that they were intended for architectural purposes, but which were scattered about on the site of the ruins. The authors have succeeded in showing clearly which way the stones were intended to be joined together, and have succeeded in constructing by means of models of these stones a façade figured on Page 38 of the work, which has certain analoga among the known remains of ancient Peruvian civilization.

In the discussion of the probable origin of the ruins the authors have reached the conclusion that the ancestors of the Aymara were probably their builders. The large and interesting figure over the gateway of Tiahuanaco is interpreted as the Deity of Light.

It must be added that the printing and the plates of the work are beautifully executed. The work ranks in importance with the former contributions from Dr. Stübel on the ancient civilization of South America.

Science and Education. By THOMAS H. HUXLEY. New York, D. Appleton & Co. $1.25.

THIS, the third volume of Professor Huxley's "Collected Essays," consists of a number of papers and addresses, most, if not all, of which have been published in some form before. The first one, on Joseph Priestley, is commemorative of a prominent worker in science and other departments, and will interest those who like to trace the history of knowledge and opinion. The remaining essays deal with various aspects of the educational problem, especially in its relations to pure and applied science. Some of them are devoted to general education, both elementary and higher, while others discuss the more special topics of medical and technical education. On the last-named subject Mr. Huxley speaks with some hesitation, and, while insisting on the importance of scientific training as a preparation for the higher kinds of technical work, maintains that handicrafts can only be learned in the workshop. Medical education, he thinks, needs to be improved in two ways, by excluding some subjects that are commonly included in it and by making the study of the remaining subjects more thorough and profound; and it is somewhat remarkable that one of the studies that he would exclude from the medical curriculum is his own favorite science of comparative anatomy. In treating the subject of education in general, Mr. Huxley, as our readers know, has always been a strong advocate of a more thorough and extensive study of physical science, and his influence in promoting that study has doubtless been considerable; yet he is by no means unmindful of the just claims of other studies. Metaphysics and theology are of course excluded from his curriculum; but he lays stress on the need of logic and psychology as well as of ethics and the social sciences, and he shows a keen appreciation of the "pleasure without alloy" to be derived from the arts of beauty. Several points in his discussion of university education might give occasion for criticism if we had space and time for the purpose, yet with the greater part of his views we cordially agree, and, even where we are obliged to dissent, we generally find his remarks suggestive. Consisting, as the book does, of separate essays prepared at various times during a period of forty years, it lacks the systematic character of a regular treatise; yet it is well worth the attention of all professional educators, and especially of the teachers of physical and medical science.

The Dawn of Astronomy; A Study of the Temple-worship and Mythology of the Ancient Egyptians. By J. NORMAN LOCKYER, F.R.S. New York and London, Macmillan and Co., 1894, 432 p.

THIS handsome volume, presented on excellent paper, in clear type, and with abundant illustrations, will be considered a valuable addition to the early history and archæology of Egypt and Babylonia, even by those who are unable to accept the author's deductions in many of their details.

He certainly shows by a variety of evidence that most of the earliest architectural monuments were constructed with reference to the positions of heavenly bodies at certain seasons; and therefore that the close observation

and the religious respect of such bodies formed two leading features in ancient science and mythology. In some of the earlier chapters he very properly gives the elements of astronomical knowledge requisite to calculating the position of the stars at fixed periods, and also the methods for determining with accuracy the "orientation" of buildings. This is by no means the same everywhere, and he justly observes that where we find such a contrast as in the temples of Thebes and Memphis, in one of which we find "solstitial" and in the other "equinoctial" orientation, it demands almost a difference of race to explain it.

Professor Lockyer, availing himself of the French and German surveys of the temples of Egypt, aided by studies of his own made on the spot, finds that one of the main objects of the temple of Karnak, for instance, was for the purpose of obtaining an exact observation of the precise time of the solstice; that many of the temples were not intended for solar but for stellar observations; and as these, owing to the change of place of the stars, would not have remained true for more than three hundred years, they furnish us a means of approximating the date of their construction. On this theory, the author calculates one of the temples at Edfu to have been constructed for the observation of the star Canopus, and to have been built about 6400 B. C. This extends the epoch of culture in Egypt far beyond the time usually fixed by modern archæologists, and illustrates the great value of the author's methods, if they should prove acceptable to the scientific world.

Several chapters of the volume are occupied with the astronomy of the early Babylonians. It would seem this was based on independent observations not less ancient than those of Egypt, but at first exerting no influence upon them. Later, at an undetermined but a very remote period, the astronomic science of northern (lower) Egypt was deeply tinged with the stellar and solar doctrines and myths of Mesopotamia.

The volume is full of suggestions for future research, and there is no question but that it puts in the hands of investigators new methods of throwing unexpected light on the origins of civilization. We earnestly hope that not in the Old World only, but in the great ruins of Mexico, Central America and Peru, they will be applied.

Inorganic Chemistry for Beginners. By SIR HENRY ROSCOE, F.R.S., D.C.L., LL.D., M.P. Assisted by JOSEPH LUNT, B.Sc. (Vict.), F.C.S. New York and London, Macmillan and Co., 1893, 245 p.

WE are always glad to welcome a text-book such as the above, and to mark its improvement over the vast number of elementary text-books in chemistry which have become so common of late. The book is arranged with a proper understanding of a beginner's necessities, and instead of a few paragraphs on chemical theory followed by a dictionary-like description of the chemical elements, we have a proper discussion of the principles, the study of the elements being introduced by a careful analysis of these principles as applied to a few, well chosen, typical examples. It is ridiculous to expect a beginner in any science to grapple at once with its particular symbols and to memorize details which are of no moment. We say of no moment, for without proper introduction these details are meaningless. The laboratory manual has too often been mistaken for a text-book of the science.

We note particularly in the above work the chapters on elements and compounds, combination in definite and multiple proportions, calculations, physical measurements, and the properties of gases. In Part II. the following non-metallic elements are studied with their more important compounds: Oxygen, hydrogen, nitrogen, chlorine, sulphur and carbon.

Principles and Practice of Agricultural Analysis. A manual for the Examination of Soils, Fertilizers and Agricultural Products. By HARVEY W. WILEY, Chemist of the United States Department of Agriculture. Easton, Pa., The Chemical Publishing Company. Vol. I., No. 1, 1894.

THE first number of this work has been received, and while it may yet be too early to judge of the character of the book as a whole, our expectations are raised, and we shall look for an epoch-making work on agricultural chemistry. Professor Wiley is of all men in this country the most competent to write upon the subject, his long connection as Chief of the Chemical Department of the United States Department of Agriculture and his many writings in scientific journals being sufficient evidence of this. Part first includes an introduction, in which the elements of the earth's "crust" are discussed, particularly in their relation to agriculture, together with the rock-forming minerals and finally the subject of rocks and rock decay. The typographic work is excellent, and the number is well illustrated with sketches and with reproductions of photographs illustrating microscopic rock structure and the physical changes in rocks. It is proposed to issue this work in twenty to twenty-four monthly parts of forty-eight pages each, selling at twenty-five cents a number.

NOTES AND NEWS.

MACMILLAN & Co.'s announcements of forthcoming books include "The Study of the Biology of Ferns by the Collodion Method," for advanced and collegiate students, by George F. Atkinson, associate professor of cryptogamic botany in Cornell University; "Mental Development in the Child and the Race," by James Mark Baldwin, Stuart professor of experimental psychology in the College of New Jersey, author of "Handbook of Psychology," etc.; "Materials for the Study of Variation in Animals," part i., "Discontinuous Variation," by William Bateson, M. A., Balfour student and fellow of St. John's College, Cambridge, illustrated; "A Three Months' Course of Practical Instruction in Botany," by F. O. Bower, D.Sc., regius professor of botany in the University of Glasgow; abridged edition of "A Course of Practical Instruction in Botany," by the same author; "A History of Mathematics," by Florian Cajori, professor in Colorado College; "A Course in Experimental Psychology," by James McKeen Cattell, A.M., Ph.D., professor of experimental psychology in Columbia College; "The Gypsy Road, a Journey from Krakow to Coblenz," by Professor G. A. J. Cole, M.R.I.A., F.G.S., illustrated; "Elements of Metaphysics," by Professor Karl Deussen, of Kiel, authorized translation; "Life in Ancient Egypt," described by Adolf Erman, translated by H. M. Tirard, with numerous illustrations and maps; "Physiology for Beginners," by Michael Foster, M.A., M.D., LL.D., F.R.S., and L. E. Shore, M.A., M.D., B.C.; "Western Europe in the Fifth Century," lectures delivered at Oxford, by E. A. Freeman, D.C.L., late regius professor of modern history in the University of Oxford; "Western Europe in the Eighth Century," lectures delivered at Oxford by E. A. Freeman, D.C.L.; "The Life of Sir A. C. Ramsay," by Sir Archibald Geikie, F.R.S.; "A Short Manual of Philology for Classical Students," by P. Giles, M.A., fellow of Gonville and Caius College, reader in philology in the University, Cambridge, uniform with Dr. Gow's "Companion to School Classics"; "Town Life in the Fifteenth Century," by Alice Stopford Green, in two volumes, 8vo; "Hydrostatics," by A. G. Greenhill, F.R.S., professor of mathematics to the senior class of artillery officers,

Woolwich; "Logic," by Williston S. Hough, A.M., assistant professor of mental and moral philosophy in the University of Minnesota; "Methods of Histological Research," for the use of students and physicians, by Dr. C. von Kahlden, lecturer in the University of Freiburg, translated by H. Morley Fletcher, M.A., M.B.; "Popular Lectures and Addresses," Vol. II., contributions to geology, by Lord Kelvin, P.R.S. (Sir William Thomson); "Sketches in Sport and Natural History," by the late George Kingsley, M.D.; "Text-book of Embryology: Invertebrates," by Drs. Korscheldt and Heider, privatdocenten, University of Berlin, translated and edited by Edward Laurens Mark, Ph.D., Hersey professor of anatomy, Harvard University, and William McMichael Woodworth, Ph.D., instructor of microscopical anatomy, Harvard University, fully illustrated; "Organic Chemistry," tranlated by Alexander Smith, professor of chemistry in Wabash College; "Macmillan's School Library," "Town Geology," by Charles Kingsley; "Physiography for Beginners," by J. E. Marr, F.R.S., F.G.S., and Alfred Harker, M.A., F.G.S.; "Pain, Pleasure and Æsthetics," an essay concerning the psychology of pain and pleasure, with special reference to æsthetics, by Henry Rutgers Marshall, M.A.; "A Manual of Laboratory Physics," by Edward L. Nichols, Ph.D., professor of physics, Cornell University; "A Manual of Physical and Chemical Measurements," by Professor Wilhelm Ostwald, translated by Dr. James Walker; "The Theory of Heat," by Thomas Preston, M.A., Trinity College, Dublin, with illustrations; "The Theory of Sound," by Lord Rayleigh, F.R.S., formerly fellow of Trinity College, Cambridge, new edition, in 2 vols., 8vo (in this new edition the whole subject will be included in two volumes); "Modern Plane Geometry," by the Rev. G. Richardson, assistant master at Winchester College, and A. S. Ramsey, Fettes College, Edinburgh; "The Rise and Development of Organic Chemistry," by the late C. Schorlemmer, F.R.S., translated and edited by Professor Smithells, Yorkshire College, Leeds; "Atlas of Classical Antiquities," by Th. Schreiber, edited for English use by Professor W. C. F. Anderson, Firth College, Sheffield; "Systematic Survey of the Organic Matters," by Drs. G. Schultz and P. Julius, translated and edited, with extensive additions, by Arthur G. Green, F.I.C., F.C.S., examiner in coal-tar products to the City and Guilds of London Institute; "Elementary Algebra," by Charles Smith, American edition; "Geometrical Conic Sections, by Charles Smith, M.A., master of Sidney Sussex College, Cambridge; "Oxford and her Colleges," a view from the Radcliffe, by Goldwin Smith, D.C.L., author of "A Trip to England," "The United States: an Outline of Political History—1492–1871," etc., with frontispiece; "Practical Plane Geometry," by J. Humphrey Spanton, gold medallist of the Royal Academy of Arts, London, drawing instructor to the Royal Navy cadets of H.M.S. Britannia; "Elementary Mensuration," with exercises on the mensuration of plane and solid figures, by F. H. Stephens, M.A.; "Essays in Historical Chemistry," by Professor T. E. Thorpe, F.R.S.; "Organic Chemistry for beginners," by G. S. Turpin, M.A. D.Sc.; "Lectures of Human and Animal Psychology," by Wilhelm Wundt, Ph.D., M.D., Dr. Jur., professor of philosophy in the University of Leipzig, author of "Grundzüge der Physiologischen Psychologie," "Ethik," "Logik," "System der Philosophie," etc., editor of the *Philosophische Studien*, translated from the second and revised German edition (1892) by J. E. Creighton, A.B. (Dalhousie), Ph.D. (Cornell), associate professor of modern philosophy in Cornell University; and E. B. Titchener, A.B. (Oxon.), Ph.D. (Leipzig), assistant professor of psychology in Cornell University.

—The French world of science has suffered a severe loss in the recent death of Professor Edmond Fremy, of Paris. Born in 1814, his father a professor at St. Cyr, Fremy began the study of chemistry during a period of great

activity in that science and by his labors extending to the present day has done much to further its advance. His first publications date from 1835 and include many valuable memoirs, but in this country he is probably best known through his treatise on chemistry in six volumes, and through his magnificent chemical encyclopedia. Probably his most recent work is that published but a short time ago in conjunction with a pupil, M. Verneuil, a treatise on the artificial production of rubies.

—An "Elementary Textbook of Agricultural Botany of the University Extension Series," by M. C. Potter, Professor of Botany in the Durham College of Science, Newcastle-upon-Tyne, has just been published by Methuen and Co., of London. The writer considers it the best botany extant for beginners. Scientific facts are presented in such a clear, forcible and interesting way that the rudiments of botany may be acquired by its use with little effort and without the aid of a teacher. It begins at once with the study of the cell instead of the seed, as is customary in such books. He treats of the seed under the fruit where it belongs and of which it is the essential part. The study of the microscopical parts of plants is too often neglected because of a lack of knowledge of the use of the microscope and technique, without which, however, it is superficial and disjointed. There is a chapter on plant food, another on reproduction, another on grasses, another on the bean family with its bacteroids and another very valuable chapter on the commonest plant diseases. It ends with a brief system of classification. The book is invaluable to young agriculturists, for whom it was especially intended. The writer has introduced it into his beginning classes and finds it excellent.

—The Open Court Publishing Company have issued Professor Ribot's work on "The Diseases of Personality" in their Religion of Science Library. By diseases of personality M. Ribot means such nervous diseases as affect the mind, including not only the various forms of insanity but also the milder kinds of mental disorder, whether affecting the intellect or the emotions; but as the work before us was noticed in *Science* when it appeared in a bound volume some years ago, we need not dwell on the author's views now. The books forming the Religion of Science Library, of which this is the fourth, are published in pamphlet form, with good clear type, at twenty-five cents a number, or $1.50 a year, and will include works both new and old on various subjects in science and philosophy.

—The University Press at Cambridge has undertaken to publish a complete translation of the Pali Jataka or "Buddha Birth-stories," which are supposed to be the oldest collection of folk-lore stories in existence. The first volume is now in the press, and has been prepared by Mr. R. Chalmers, late of Oriel College, Oxford, a former pupil of Prof. Rhys Davids. It will contain the forty stories given in Prof. Rhys Davids's discontinued translation, but will also give the remainder of the first volume of Prof. Fausböll's edition of the Pali text. The second volume is translated by Mr. W. H. D. Rouse, Fellow of Christ's College, and the third by Mr. R. A. Neil, Fellow and assistant-tutor of Pembroke College, and Mr. H. T. Francis, under-librarian of the University Library at Cambridge and late Fellow of Gonville and Caius College. The whole translation will appear under the editorship of Prof. Cowell, of Cambridge. The work is expected to fill seven or eight volumes; but at present only five volumes of the Pali text have appeard. Each volume of the text is to be represented by a volume of the translation. This Buddhist collection of stories will be of great interest and importance for students of folk-lore; and it will also be of value as illustrating the manners and customs of ancient India. The stories are generally told in a simple popular style, with not infrequent touches of quaint humor and pathos; and they give us a moving panorama of Hindu society in the immediate centuries before our era.

EXCHANGES.

[Free of charge to all, if of satisfactory character. Address, N. D. C. Hodges, 874 Broadway, New York.]

LIVING near the famous "Serpent Mound," Adams County, Ohio, I have had opportunity to make a collection of pre-historic relics. I will sell same to any one interested in archæology. Write me. Warren Cowen, Elmville, Highland County, Ohio.

TO EXCHANGE.—Herbarium specimens. Address, H. P. Chandler, Beaver Dam, Wisc.

KARYOKINETIC FIGURES IN MAMMALIAN TISSUES.—Since the publication of my Preliminary Notice in *Science* for Dec. 1, 1893, many parties have written me asking for permanent preparations showing mitosis. To these parties I have sent slides, and I now offer to all who desire them slides showing mitotic figures in nuclei of embryo kitten. A good immersion objective is necessary to make out the figures satisfactorily. Send 60 cents in stamps. If the slide is not satisfactory, return it, and I will return the money. I do not care to exchange slides. Frank S. Aby, State University, Iowa City, Iowa.

FOR SALE.—A small collection of bird skins, consisting of 135 specimens of New England species, most of which are in good condition and all have full data. Nearly all were collected in the Connecticut valley in Massachusetts. Price, $10. Address, H. L. Clark, 3922 Fifth Avenue, Pittsburgh, Penna.

FOR SALE.—Price $150, cost originally between $300 and $400, a microscope and following accessories: Acme (No. 2), stand and case lost, $75; Crouch, one-fifth collar adjustment and objective, $25; Tollcs, four-tenths ditto, $45; Tollcs amplifier, $12; Baush and Lamb, half solid eye piece, $8; Baush and Lamb, acromatic condenser, $18; Hartnock Polarizer, $30; turn-table, $6; Hartnock, camera lucida, $20. D. T. Marshall, Metuchen, N. J.

TO EXCHANGE.—Works on entomology, botany and palaeontology for works on Indians and archæology. H. Justin Roddy, Millersville, Pa.

FOR SALE.—A Zertmayer new model U. S. Army Hospital monocular stand, cost $110. H. C. Wells, 151 Broadway, New York.

WANTS.

WANTED.—A young man to canvass for advertisements for *Science*. The usual commission of thirty per cent will be paid. Apply in person at *Science* Office, 874 Broadway, New York.

DOUBLE honor graduate in Science and Philosophy desires any suitable work in science, of the nature of teaching preferred. Address, E. A. Beckett, Trinity College, Toronto, Ontario.

WANTED.—Theory of the Earth, by Hutton. Principles of Geology, by Lyell. Manual of Geology, by Phillips. Lehrbuch der Geolgie und Petrefacenkunde, by Carl Vogt. Etudes sur le Métamorphisme, by Daubrée

WANTED.—Second-hand books on osteology, embryology, and comparative anatomy. Send list, stating condition and cash price. Can offer a few good sets of birds' eggs if desired. R. C. McGregor, Palo Alto, California.

WE are engaged in a study of the geographical distribution and osteology of our North American Box Tortoises or *Terrapene* (*Cistudo*). Specimens from Georgia, Tennessee, Alabama and the Dakotas are especially desired. Material from other localities would be welcomed. Would gladly pay expressage and return specimens if desirable. Specimens should be enclosed in a small box with but little paper (without alcohol) and addressed, W. E. Taylor, Walker Museum, University of Chicago, Chicago, Ill.

WANTED.—Addresses of persons interested in archæology. Copies of the new archæologic journal in exchange for lists of collectors. A collection of 10,000 valuable objects, the results of my nine years' exploration in the Mississippi Valley, for sale. Price, $7,650. Warren K. Moorehead, Waterloo, Indiana.